

# **EXHIBIT G**

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(Also referred to as FORM PTO-1465)**REQUEST FOR EX PARTE REEXAMINATION TRANSMITTAL FORM**Address to:  
Mail Stop *Ex Parte* Reexam  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Attorney Docket No.: 52959.54X712

Date: December 9, 2021

1. ☒ This is a request for *ex parte* reexamination pursuant to 37 CFR 1.510 of patent number 9,568,712 issued February 14, 2017. The request is made by:  
☐ patent owner ☒ third party requester.
2. ☒ The name and address of the person requesting reexamination is:  
Michael S. Parsons, HAYNES AND BOONE, LLP  
2323 Victory Avenue, Suite 700  
Dallas, Texas 75219
3. Requester ☐ asserts small entity status (37 CFR 1.27) or ☐ certifies micro entity status (37 CFR 1.29). Only a patent owner requester can certify micro entity status. Form PTO/SB/15A or B must be attached to certify micro entity status.
4. This request is accompanied by payment of the reexamination fee as set forth in:  
☒ 37 CFR 1.20(c)(2); or  
☐ 37 CFR 1.20(c)(1). In checking this box for payment of the fee set forth in 37 CFR 1.20(c)(1), requester asserts that this request has forty (40) or fewer pages and complies with all other requirements of 37 CFR 1.20(c)(1).  
 Payment of the reexamination fee is made by the method set forth below:  
 a. ☐ A check in the amount of \$\_\_\_\_\_ is enclosed to cover the reexamination fee;  
 b. ☒ The Director is hereby authorized to charge the reexamination fee to Deposit Account No. 08-1394;  
 c. ☐ Payment by credit card. Form PTO-2038 is attached, or  
 d. ☐ Payment made via EFS-Web.  
☒ In addition, the Director is hereby authorized to charge any fee deficiencies to Deposit Account No. 08-1394.
5. ☒ Any refund should be made by ☐ check or ☒ credit to Deposit Account No. 08-1394, 37 CFR 1.26(c). If payment is made by credit card, refund must be to credit card account.
6. ☒ A copy of the patent to be reexamined having a double column format on one side of a separate paper is enclosed. 37 CFR 1.510(b)(4).
7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table  
☐ Landscape Table on CD

(Page 1 of 3)

This collection of information is required by 37 CFR 1.510. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) a request for reexamination. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop *Ex Parte* Reexam, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.  
 If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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8. ☐ Nucleotide and/or Amino Acid Sequence Submission.  
If applicable, items a. – c. are required.
- a. ☐ Computer Readable Form (CRF)
- b. Specification Sequence Listing on:
- i. ☐ CD-ROM (2 copies) or CD-R (2 copies) or
- ii. ☐ paper
- c. ☐ Statements verifying identity of above copies.
9. ☒ A copy of any disclaimer, certificate of correction or reexamination certificate issued in the patent is included.
10. ☒ Reexamination of claim(s) 3-6, 8-11 and 14 is requested.
11. ☒ A copy of every patent or printed publication relied upon is submitted herewith including a listing thereof on Form PTO/SB/08, PTO-1449, or equivalent.
12. ☐ An English language translation of all necessary and pertinent non-English language patents and/or printed publications is attached.
13. ☒ The attached detailed request includes at least the following items:
- a. A statement identifying each substantial new question of patentability based on prior patents and printed publications. 37 CFR 1.510(b)(1).
- b. An identification of every claim for which reexamination is requested, and a detailed explanation of the pertinency and manner of applying the cited art to every claim for which reexamination is requested. 37 CFR 1.510(b)(2).
14. ☐ A proposed amendment is included (only where the patent owner is the requester). 37 CFR 1.510(e).
15. ☒ It is certified that the statutory estoppel provisions of 35 U.S.C. 315(e)(1) or 35 U.S.C. 325(e)(1) do not prohibit requester from filing this *ex parte* reexamination request. 37 CFR 1.510(b)(6).
16. Service
- a. ☒ It is certified that a copy of this request (if filed by other than the patent owner) has been served in its entirety on the patent owner as provided in 37 CFR 1.33(c).
- The name and address of the party served are:
- Nathan & Associates Patent Agents Ltd
- P.O. Box 10178
- Tel Aviv 6110101
- Date of Service: December 9, 2021
- OR
- b. ☐ A duplicate copy is enclosed since service on patent owner was not possible. An explanation of the efforts made to serve patent owner is attached. See MPEP 2220.



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17. Correspondence Address: Direct all communication about the reexamination to:

☒ The address associated with Customer Number: 27683

OR

☐ Firm or Individual Name \_\_\_\_\_  
(at the address identified below)

Address

City

State

Zip

Country

Telephone

214-651-5000

Email

IPDOCKETING@HAYNESBOONE.COM

18. ☒ The patent is currently the subject of the following concurrent proceeding(s):

- a. ☐ Copending reissue Application No. \_\_\_\_\_
- b. ☒ Copending reexamination Control No. Apple Inc. v. Corephotonics LTD, IPR2018-01146; and Apple Inc. v. Corephotonics LTD, IPR2018-01156
- c. ☐ Copending Interference No. \_\_\_\_\_
- d. ☒ Copending litigation styled:  
Apple Inc. v. Corephotonics LTD, Case No. 5:18-cv-02555 (N.D. Cal. 2018); and  
Apple Inc. v. Corephotonics LTD, Case No. 5:17-cv-06457, (N.D. Cal. 2018)

WARNING : Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/Michael S. Parsons/

Authorized Signature

December 9, 2021

Date

Michael S. Parsons

Typed/Printed Name

58,767

Registration No.

☐ For Patent Owner Requester☒ For Third Party Requester

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re patent of Michael Dror et al.	§ REQUEST FOR <i>EX PARTE</i>
	§ REEXAMINATION
U.S. Patent No. 9,568,712	§
	§ Attorney Docket No.: 52959.54US01
Filed: June 1, 2016	§
	§
Issued: February 14, 2017	§ Customer No.: 27683
	§
Title: Miniature Telephoto Lens	§ Real Party in Interest:
Assembly	§ Apple Inc.
	§

**REQUESTER'S POWER OF ATTORNEY  
PURSUANT TO 37 CFR 1.510(f)**

Pursuant to 37 CFR 1.510(f) Requester, **APPLE INC.** hereby appoints the Practitioner(s) associated with **Customer Number 27683**, as its attorney(s) to prosecute and to transact all business in the United States Patent and Trademark Office in connection with the above-identified request for *Ex Parte* Reexamination. Please recognize the correspondence address (including any electronic mail address) associated with **Customer Number 27683** for the above-identified *Ex Parte* Reexamination proceeding number to be the address associated with the appointed counsel(s).

The undersigned is authorized to sign this Power of Attorney on behalf of the Requester.

Executed on 12/7/21.

**APPLE INC.**

By:  \_\_\_\_\_

Printed Name: Jeffrey L. Myers

Title: Chief IP Counsel



In place of PTO-1449 Form		U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		<i>Complete if Known</i>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> <i>(use as many sheets as necessary)</i>				Application Number	In Ex Parte Reexamination of 9,568,712
				Filing Date	June 1, 2016
				First Inventor Name	Michael Dror
				Art Unit	TBD
				Examiner Name	TBD
SHEET	1	OF	1	Attorney Docket Number	52959.54X712

U. S. PATENTS				
Examiner's Initials	Cite No.	Document Number	Issue Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	Exhibit B	9128267	09-08-2015	Ogino et al.
	Exhibit C	8233224	07-31-2012	Chen

U. S. PATENT APPLICATION PUBLICATIONS				
Examiner's Initials	Cite No.	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document

FOREIGN PATENT DOCUMENTS					
Examiner's Initials	Cite No.	Foreign Patent Document (Country Code – Number – Kind)	Publication Date MM-DD-YYYY	Patentee or Applicant of Cited Document	Translation Y/N

NON-PATENT LITERATURE DOCUMENTS		
Examiner's Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item, date, page(s), volume-issue number(s), publisher, city/country where published
	Exhibit D	Bareau et al., "The optics of miniature digital camera modules," SPIE Proceedings Volume 6342, International Optical Design Conference 2006: 63421F (2006) <a href="https://doi.org/10.1117/12.692291">https://doi.org/10.1117/12.692291</a> ("Bareau")

Examiner Signature		Date Considered	
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Request for <i>Ex Parte</i> Reexamination	§	
	§	
U.S. Patent No. 9,568,712	§	REQUEST FOR <i>EX PARTE</i>
	§	REEXAMINATION
Issued: December 7, 2021	§	
	§	
For: MINIATURE TELEPHOTO LENS	§	Attorney Docket No.: 52959.54X712
ASSEMBLY	§	
	§	Customer No.: 27683
	§	

**REQUEST FOR *EX PARTE* REEXAMINATION**

Mail Stop *Ex Parte* Reexam  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to the provisions of 35 U.S.C. §§ 302-307, the undersigned (hereinafter “Requester,” representing Apple Inc. (“Apple”)), hereby requests *ex parte* reexamination of claims 3-6, 8-11, and 14 of U.S. Patent No. 9,568,712 (“the ’712 Patent,” a copy of which is provided as Exhibit A in accordance with 37 CFR § 1.510(b)(4)) that issued on February 14, 2017 to Michael Dror et al. resulting from a patent application filed on June 1, 2016.



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VIII.	UNDER 37 C.F.R. § 1.510(B)(3) COPIES OF PATENTS AND PRINTED PUBLICATIONS RELIED UPON OR REFERENCED ARE PROVIDED AS EXHIBITS .....	30
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## I. INTRODUCTION

1) This is a request for *ex parte* reexamination of claims 3-6, 8-11, and 14 of U.S. Patent No. 9,568,712 (“the ’712 Patent”). This request presents new arguments that are not the same or substantially the same as arguments presented during prosecution or in the IPRs previously filed by Requester titled *Apple Inc. v. Corephotonics LTD*, IPR2018-01146 and *Apple Inc. v. Corephotonics LTD*, IPR2018-01356. Specifically, claims 3-6, 8-11, and 14 are shown herein to be obvious over a modified lens design that applies the teachings of Chen and Bareau to Ogino’s Example 5 lens assembly. This modified lens design was found by the Board to render obvious similar claims of U.S. Patent No. 10,317,647 (*see* Ex. N (FWD in IPR2020-00896)), a continuation of the ’712 Patent. In the ’896 IPR, the Board also found the modified lens design to be the successful result of a POSITA applying the teachings of Chen and Bareau to Ogino’s Example 5 lens assembly in the manner described in detail below. There can therefore be no dispute here that a POSITA would have combined Ogino, Chen, and Bareau to arrive at the modified design that renders the claims obvious here in a similar fashion as shown in the ’896 IPR.

2) The modified lens design resulting from the combination of Ogino, Chen, and Bareau is not the same as or substantially the same as the lens designs previously applied in the ’1146 IPR from Konno and the ’1356 IPR from Iwasaki at least because Ogino’s Example 5—the starting point for the combination—is a completely different lens design with features different from those previously referenced from Konno and Iwasaki. Thus, this request presents new, noncumulative teachings of the prior art that the Board has already found renders similar claims obvious.

3) Apple has not previously challenged claims 3-5 and 8-11 in any post-issuance proceeding and is not estopped on challenging these claims here. While Apple previously challenged claims 6 and 14 in the ’1146 IPR, it is not estopped from also challenging these claims here since the final written decision was vacated and remanded with respect to these claims and is still awaiting a new final written decision. Additionally, since the claims challenged here depend from at least one of claims 1, 2, 12, and 13, the analysis referenced herein shows how the combination of Ogino, Chen and Bareau similarly renders these claims obvious. These claims should also be rejected based on Federal Circuit precedent since the challenged claims are all shown to be obvious. Apple is not challenging claims 1, 2, 7, 12, 13,



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15, 16, and 19 here but arguments and analysis are included in this request and referenced in the exhibits showing that the same combination of Ogino, Chen, and Bareau teaches the elements of these claims and supports the Office issuing its own rejection under § 103 *sua sponte*.

4) This request for *ex parte* reexamination is being filed now to ensure that the Office has the opportunity to consider—and more importantly, rule on—the substantial new question of patentability presented by the combination of Ogino, Chen, and Bareau, which the Board has already upheld in invalidating similar claims of a related patent.

## **II. IDENTIFICATION UNDER 37 C.F.R. § 1.510(B)(2) OF CLAIMS FOR WHICH REEXAMINATION IS REQUESTED AND CITATION OF PATENTS AND PRINTED PUBLICATIONS PRESENTED TO PROVIDE A SUBSTANTIAL NEW QUESTION OF PATENTABILITY**

5) Requester identifies claims 3-6, 8-11, and 14 of U.S. Patent No. 9,568,712 (“the ’712 Patent”) for which reexamination is requested in view of the following references:

- |           |   |
|-----------|---|
| Exhibit B | Ogino et al., U.S. Patent No. 9,128,267, filed March 24, 2014 (claiming priority to Japanese Application No. 2013-072282 filed March 29, 2013), issued September 8, 2015 (“Ogino”);   |
| Exhibit C | Chen, U.S. Patent No. 8,233,224, filed January 8, 2010 (claiming priority to Taiwanese Application No. 98123694A filed July 14, 2009), issued July 31, 2012 (“Chen”);   |
| Exhibit D | Bareau et al., “The optics of miniature digital camera modules,” SPIE Proceedings Volume 6342, <i>International Optical Design Conference 2006</i> ; 63421F (2006) <a href="https://doi.org/10.1117/12.692291">https://doi.org/10.1117/12.692291</a> (“Bareau”) |

6) A copy of each relied upon patent or printed publication in accordance with 37 C.F.R. §1.510(b) is provided in the accompanying Exhibits. A complete listing of all the Exhibits is provided at the end of this request.

## **III. RELATED PROCEEDINGS**

### **A. *Inter Partes* Review Proceeding**

7) The ’712 Patent is the subject of two *inter partes* review proceedings, namely, *Apple Inc. v. Corephotonics LTD*, IPR2018-01146 (“the ’1146 IPR”) and *Apple Inc. v. Corephotonics LTD*, IPR2018-01356 (“the ’1356 IPR”). In the ’1146 IPR, Petitioner Apple

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challenged claims 1, 2, 7, 12, 13, 15, 16, and 19 as anticipated by Japanese Patent Publication No. JP2013106289 to Konno et al. (“Konno”), claims 6 and 14 as unpatentable over Konno in view of “The optics of miniature digital camera modules,” SPIE Proceedings Volume 6342, International Optical Design Conference 2006; 63421F (2006) by Bareau et al. (“Bareau”), and claims 15-17 as anticipated by U.S. Patent No. 3,388,956 to Eggert et al (“Eggert”). On December 4, 2019, the Patent Trial and Appeal Board (“Board”) issued a Final Written Decision concluding that:

- Petitioner has demonstrated, by a preponderance of the evidence, that claims 15-17 are anticipated by Eggert;
- Petitioner has not demonstrated, by a preponderance of the evidence, that claims 1, 2, 7, 12, 13, 15, 16, and 19 are anticipated by Konno; and
- Petitioner has not demonstrated, by a preponderance of the evidence, that claims 6 and 14 are obvious over Konno and Bareau.

A copy of the Board’s Final Written Decision in IPR2018-01146 is provided at Exhibit F.

8) Apple then appealed the Final Written Decision in *Apple Inc. v. Corephotonics, LTD*, CAFC-20-1438. On June 23, 2021, the Federal Circuit issued a nonprecedential decision:

- affirming the Board’s finding of no anticipation for claims 1, 2, 7, 12, 13, 15, 16 and 19; and
- vacating the Board’s determination of nonobviousness for claims 6 and 14 and remanding for reconsideration.

A copy of the Federal Circuit’s Decision in CAFC-20-1438 is provided at Exhibit G.

9) Thereafter, on October 22, 2021, the Board issued an order authorizing opening and responsive briefs on the subject of obviousness of claims 6 and 14. A Final Written Decision deciding this matter has not yet been issued.

10) In the ’1356 IPR, Petitioner Apple challenged claims 1 and 12-14 as anticipated by U.S. Patent No. 9,678,310 to Iwasaki et al. (“Iwasaki”). On February 5, 2019, the Patent Trial and Appeal Board (“Board”) issued a Decision exercising its discretion to deny institution of the ’1356 IPR. This decision was based on:

- General Plastics factors that weighed in favor of exercising discretion given that the ’1146 IPR was already pending; and



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- No explanation of how Petitioner's application of Iwasaki differs substantially from its application of Konno in the '1146 IPR.

A copy of the Board's Decision in IPR2018-01356 is provided at Exhibit H.

11) On December 7, 2021, the Final Written Decision issued in IPR2020-00896 (Exhibit N) involving U.S. Patent No. 10,317,647 ("the '647 Patent"), which is a continuation of the '712 Patent. In that decision, the Board found that a lens assembly modified using the teachings of Ogino's Example 5, Chen's second meniscus lens, and Bareau's f-number specification renders obvious several claims of the '647 Patent. This same combination based on Ogino, Chen, and Bareau, which the Board found to render obvious claims of the '647 Patent, also renders obvious claims from the related '712 Patent, for the same and similar reasons as for the '647 Patent. Because the Board has already decided that a POSITA would have been motivated to combine the teachings of Ogino, Chen, and Bareau, and that a lens design derived from those combined teachings would have been obvious to a POSITA, there can be no dispute that the same lens design applied here also would have been obvious to a POSITA.

#### **B. Litigation Involving the '712 Patent**

12) The '712 patent is also the subject of ongoing litigation, namely, *Apple Inc. v. Corephotonics LTD*, Case No. 5:18-cv-02555 (N.D. Cal. 2018), consolidated with *Apple Inc. v. Corephotonics LTD*, Case No. 5:17-cv-06457, (N.D. Cal. 2018) (collectively, "the '712 Litigation"). The district court *sua sponte* stayed the '712 Litigation. Order *Sua Sponte* Staying Cases Pending Resolution of IPR Proceedings (Exhibit I).

### **IV. CERTIFICATION UNDER 37 C.F.R. § 1.510(B)(6) THAT STATUTORY ESTOPPEL DOES NOT APPLY**

13) Requester certifies that the statutory estoppel provisions of 35 U.S.C. § 315(e)(1) or 35 U.S.C. § 325(e)(1) do not prohibit the Requester from filing this *ex parte* reexamination request.

#### **A. 35 U.S.C. § 315(e)(1)**

14) 35 U.S.C. § 315(e)(1) recites:

(1) PROCEEDINGS BEFORE THE OFFICE.—The petitioner in an inter partes review of a claim in a patent under this chapter that results in a final written decision under section 318(a), or the real party in interest or privy



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of the petitioner, may not request or maintain a proceeding before the Office with respect to that claim on any ground that the petitioner raised or reasonably could have raised during that inter partes review.

15) The party making this request for *ex parte* reexamination of the '712 Patent is Apple, who is also the petitioner in the '1146 and '1356 IPRs.

16) Here, the only final written decision to issue was in the '1146 IPR, which was vacated and remanded by the Federal Circuit as to claims 6 and 14. As a result of the final written decision being vacated and remanded, estoppel under § 315(e)(1) does not apply to claims 6 and 14. *See, e.g., General Access Solutions, LTD v. Sprint Spectrum LP*, Case No. 2:20-CV-00007-RWS, at 4-5 (E.D. Tex. Dec. 1, 2020) (finding that Petitioner estoppel in district court under § 315(e)(2) does not apply to claims where the Federal Circuit vacated the final written decision). Estoppel also does not apply to claims 3-5 and 8-11 that have not been previously challenged by Apple. The '1356 IPR also does not estop Apple because the Board denied institution of the without deciding the merits of the Petition, so a final written decision never issued.

**B. 35 U.S.C. § 325(e)(1)**

17) 35 U.S.C. § 325(e)(1) recites:

(1) PROCEEDINGS BEFORE THE OFFICE.—The petitioner in a post-grant review of a claim in a patent under this chapter that results in a final written decision under section 328(a), or the real party in interest or privy of the petitioner, may not request or maintain a proceeding before the Office with respect to that claim on any ground that the petitioner raised or reasonably could have raised during that post-grant review.

18) Here, Apple has not sought post-grant review (PGR) of the '712 Patent, and as such, estoppel under 35 U.S.C. § 325(e)(1) does not apply.

**V. THIS REQUEST IS NOT REDUNDANT AND SHOULD NOT BE REJECTED UNDER 35 U.S.C. § 325(d)**

19) As discussed below, this request raises substantial new questions of patentability with respect to claims 3-6, 8-11, and 14 of the '712 Patent based on the combination of Ogino, Chen, and Bareau, which is the same combination that the Board found rendered obvious several claims of the related '647 Patent in IPR2020-00896 (*see* Exhibit N). Ogino and Chen and the arguments based on these references below are not the same or substantially the same as either



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the Konno or Iwasaki references applied in the '1146 and '1356 IPRs because Ogino and Chen teach different prior art lens designs that, when combined with Bareau, renders the claims obvious in a way that was not previously presented during prosecution or *inter partes* review of the '712 Patent. Thus, this request should not be rejected under 35 U.S.C. § 325(d) because it does not present “the same or substantially the same prior art or arguments previously [] presented to the Office” with respect to claims 6 and 14. 35 U.S.C. § 325(d). Also, claims 3-5 and 8-11 have not previously been challenged post-issuance, so § 325(d) does not apply.

## **VI. STATEMENT UNDER 37 C.F.R. § 1.510(B)(1) OF EACH SUBSTANTIAL NEW QUESTION OF PATENTABILITY**

20) Substantial new questions of patentability exist for the '712 Patent because the prior art references discussed herein provide new, non-cumulative technological teachings (the combination of Ogino, Chen, and Bareau) that were not previously considered and discussed on the record during the original prosecution or *inter partes* review of the '712 Patent, and render claims 3-6, 8-11, and 14 (and the claims from which they depend (i.e., claims 1, 2, 12, and 13)) obvious. The Board in the '896 IPR has already determined that a POSITA would have combined Ogino, Chen, and Bareau in the way set forth below to arrive at a lens assembly design that renders the claims obvious in a similar manner as the claims found obvious in the '896 IPR. *See Ex. N*, pp.43-55. An overview of the '712 Patent, including a discussion of its original prosecution history and reasons for allowance, as well the '1146 and '1356 IPRs, is provided below. The following is a description of the substantial new questions of patentability for this request.

### **A. Overview of the '712 Patent**

21) The '712 Patent issued from Application No. 15/170,472 filed on June 1, 2016, which is a continuation of a family of patents ultimately claiming priority to U.S. Provisional Application No. 61/842,987 filed July 4, 2013, the earliest possible priority date to which the '712 Patent is entitled.

22) The '712 Patent is directed to “[a]n optical lens assembly [that] includes five lens elements and provides a TTL/EFL<1.0” and is allegedly the answer to the need for good quality imaging and a small total track length. *Ex. A*, Abstract, 1:38-50. The definition of a telephoto lens system in the art is a system in which the ratio of TTL (“total track length”) over EFL

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("effective focal length") is less than one. One embodiment of such a system is illustrated in FIG. 1A, reproduced below:

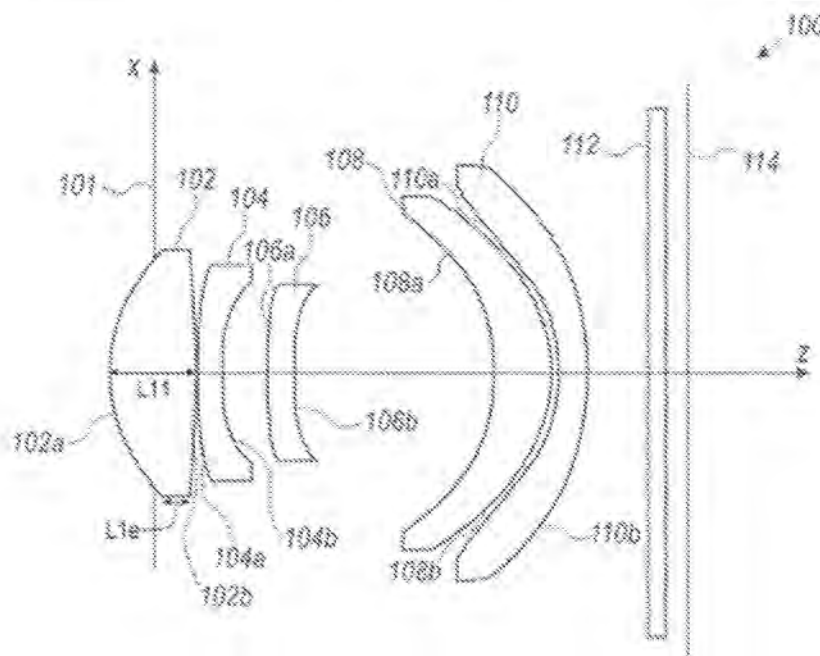


FIG. 1A

23) In the '712 patent, all of the embodiments have a TTL to EFL ratio less than 1.0 and an F number ("F#") of less than 3.2. Exhibit A, 1:66-2:3. Other claimed characteristics applicable to only some embodiments include the lens elements having certain Abbe numbers, specified air gaps being between certain lens elements, and the surfaces of the lens elements being aspheric. *See id.*, 2:4-9.

#### **B. Exemplary Claim of '712 Patent**

24) Claims 1, 2, and 6 are representative and recite:

1. A lens assembly, comprising: a plurality of refractive lens elements arranged along an optical axis, wherein at least one surface of at least one of the plurality of lens elements is aspheric, wherein the lens assembly has an effective focal length (EFL), a total track length (TTL) of 6.5 millimeters or less and a ratio TTL/EFL of less than 1.0, and wherein the plurality of lens elements comprises, in order from an object side to an image side, a first lens element with a focal length  $f_1$  and positive refractive power, a second lens element with a focal length  $f_2$  and negative refractive power and a third lens element with a focal length  $f_3$ , the focal length  $f_1$ , the focal length  $f_2$  and the focal length  $f_3$  fulfilling the condition  $1.2 \times |f_3| > |f_2| > 1.5 \times f_1$ .



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2. The lens assembly of claim 1, wherein the plurality of lens elements further comprises a fourth lens element, the third and fourth lens elements being separated by an air gap greater than TTL/5.

6. The lens assembly of claim 2, wherein a lens assembly F# is smaller than 2.9.

### **C. Original Prosecution History**

25) During the original prosecution of the application for the '712 Patent, the Examiner did not reject any claims, based on prior art or otherwise. Instead, in a Notice of Allowability dated November 9, 2016, the Examiner allowed all of the claims as originally filed, giving the following Statement of Reasons for Allowance (Exhibit J):

#### **REASONS FOR ALLOWANCE**

2. The following is an examiner's statement of reasons for allowance:

The prior art does not show or fairly suggest the claimed invention of an optical image capturing system having the claimed structure and claimed limitations, wherein a rejection under 35 USC 102 or 103 would be improper. Please particularly note the combination of claimed elements and claimed limitations, including as recited in independent claim 1 (with claims 2-14 dependent thereon) and as recited in independent claim 15 (with claims 16-19 dependent thereon), the combination of recited structural limitations and conditional statements which must be met; as well as the approved terminal disclaimer filed on 10-9-16.

The application issued as the '712 Patent on February 14, 2017.

### **D. Summary of IPR2018-01146**

26) In the '1146 IPR, Petitioner Apple challenged claims 1, 2, 7, 12, 13, 15, 16, and 19 of the '712 Patent as being anticipated by Konno, claims 6 and 14 as being unpatentable over Konno in view of Bureau, and claims 15-17 as anticipated by Eggert. *See* '1146 Petition (Exhibit K) at 12-62.

27) In the Final Written Decision issued December 4, 2019, the Board determined that Apple failed to demonstrate that claims 1, 2, 7, 12, 13, 15, 16, and 19 were anticipated by Konno based on the overlap of lenses L4 and L5 that "is sufficient to render Konno's Example 2-LN2 lens assembly non-enabled." Ex. F, p.23. The Board also found that Apple did not establish, by a

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preponderance of the evidence, that claims 6 and 14 are obvious because it was not persuaded by Apple's rationale for lowering the f-number of Konno's Ex2-LN2 telephoto lens based on Bareau. Claims 15-17 were found unpatentable as anticipated by Eggert.

28) Thereafter, Apple appealed the Final Written Decision in the '1146 IPR. On June 23, 2021 (Exhibit G), the Federal Circuit issued a nonprecedential decision affirming the Board's finding of no anticipation for claims 1, 2, 7, 12, 13, 15, 16 and 19 and vacating the Board's determination of nonobviousness for claims 6 and 14 and remanding back to the Board for reconsideration. A final written decision addressing claims 6 and 14 has not yet issued.

#### **E. Definition of a Person of Ordinary Skill in the Art**

29) A person of ordinary skill in the art in the field of the '712 Patent as of July 4, 2013 would include someone who had (i) a Bachelor's degree in Physics, Optical Sciences, or equivalent training, as well as (ii) approximately three years of experience in designing multi-lens optical systems. Such a person would have had experience in analyzing, tolerancing, adjusting, and optimizing multilens systems, and would have been familiar with the specifications of lens systems. In addition, a POSITA would have known how to use lens design software such as Code V, Oslo, or Zemax, and would have taken a lens design course. Lack of work experience can be remedied by additional education, and vice versa. *See* Ex. K, pp.7-8; Ex. O, ¶¶ 18-21. The Final Written Decision in the '1146 IPR determined that this level of ordinary skill "is consistent with the '712 patent and the asserted prior art." *See* Ex. F, p.18.

#### **F. Substantial New Questions of Patentability**

30) This request presents substantial new questions of patentability for claims 3-6, 8-11, and 14 of the '712 Patent in light of previously uncited and non-cumulative references—namely, the combination of Ogino, Chen, and Bareau—that teaches all of the lens assembly features recited in the challenged claims and the claims from which they depend (i.e., claims 1, 2, 12, and 13), and therefore renders the challenged claims obvious. The prior art lens design of Ogino modified based on Chen and Bareau presented here is not the same design nor is it cumulative to prior art lens designs applied in the '1146 IPR (i.e., Konno) and the '1136 IPR (i.e., Iwasaki).



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## VII. DETAILED EXPLANATION UNDER 37 C.F.R. § 1.510(B)(2) OF THE PERTINENCY AND MANNER OF APPLYING THE CITED PRIOR ART TO THE IDENTIFIED CLAIMS

31) A summary of the prior art cited in the present request is provided below, followed by a listing of proposed rejections and a detailed explanation of the pertinency and manner of applying these references to every claim for which reexamination is requested.

### B. Summary of the Cited Prior Art

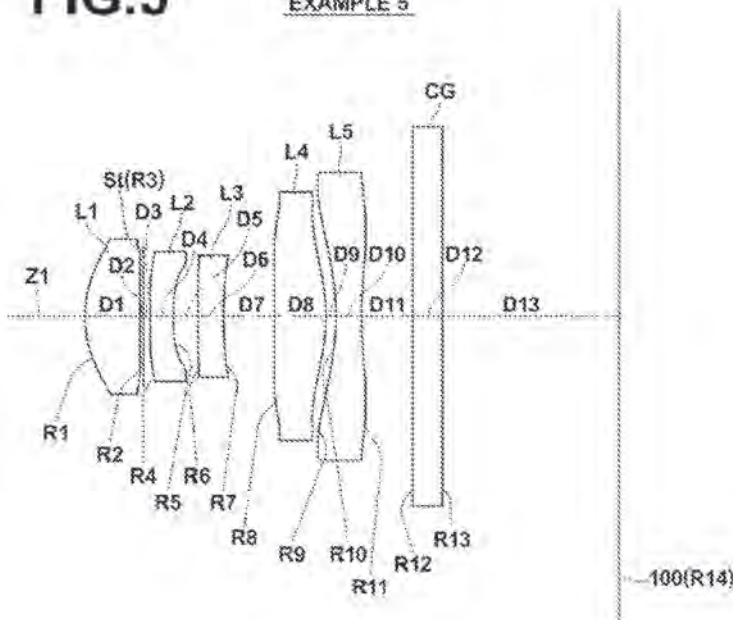
#### 4. Ogino

32) U.S. Patent No. 9,128,267 to Ogino et al. (“Ogino”) was filed on March 26, 2014, and claims priority to Japanese Application No. 2013-072282 filed March 29, 2013. Due to relying on its foreign filing date, Ogino qualifies as a prior art reference for the '712 Patent at least under 35 U.S.C. § 102(a)(2). Ogino was not cited or discussed during the original examination of the '712 Patent or in the '1146 or '1356 IPRs.

33) Ogino discloses a five-lens system designed “to enhance the resolution and performance of the imaging lens” for portable devices. Ex. B, 1:11-16, 1:30-31. Ogino’s Example 5 is below:

**FIG.5**

EXAMPLE 5



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34) In Example 5, lens elements L1-L5 are arranged in order along the optical axis Z1 which includes a cover glass (CG) “disposed between the fifth lens L5 and the imaging device 100 ....” *Id.*, 13:4-5, 5:55-6:2. Example 5 is described by prescription data in Table 9:

TABLE 9

---

EXAMPLE 5  
 $f = 5.956$ ,  $Bf = 2.438$ ,  $IL = 5.171$

---

Si	Ri	Di	ndj	vdj
*1	1.12444	0.346	1.54488	54.87
*2	253.97534	0.030		
3	$\infty$	0.060		
(APERTURE STOP)				
*4	-18.78836	0.227	1.63351	23.63
*5	12.25616	0.243		
*6	506.45581	0.253	1.63351	23.63
*7	0.203603	0.506		
*8	-99.83715	0.896	1.63351	23.63
*9	-1.70702	0.110		
*10	-2.17466	0.253	1.54488	54.87
*11	3.61429	0.590		
12	$\infty$	0.360	1.51633	54.14
13	$\infty$	1.740		
14	$\infty$			

---

\*ASEPHERIC SURFACE

35) Table 9 includes column ‘Di’ (on-axis thickness of and spacing between each lens element), column ‘ndj’ (refractive index of each surface), and column ‘vdj’ (Abbe number of each element). See, e.g., *id.*, 14:31-53. Table 9 also shows the focal length (EFL) as  $f=5.956$ . *Id.*

36) This explanation of Ogino’s Example 5 is consistent with the Board’s summary in 896 IPR’s final written decision. See Ex. N, pp.18-19.

#### 4. Chen

37) U.S. Patent No. 8,233,224 to Chen, filed January 8, 2010 (claiming priority to Taiwanese Application No. 98123694A filed July 14, 2009), issued July 31, 2012, and thus qualifies as prior art to the ’712 Patent at least under AIA 35 U.S.C. § 102(a)(1). Chen was cited in the ’1146 IPR as evidence of the knowledge of a POSITA regarding meniscus lens shapes (*see* Ex. K, 45-46), but Chen applied against the claims of the ’712 Patent, and was not combined with Konno or Ogino in that proceeding. Also, Chen was not cited in the ’1356 IPR.

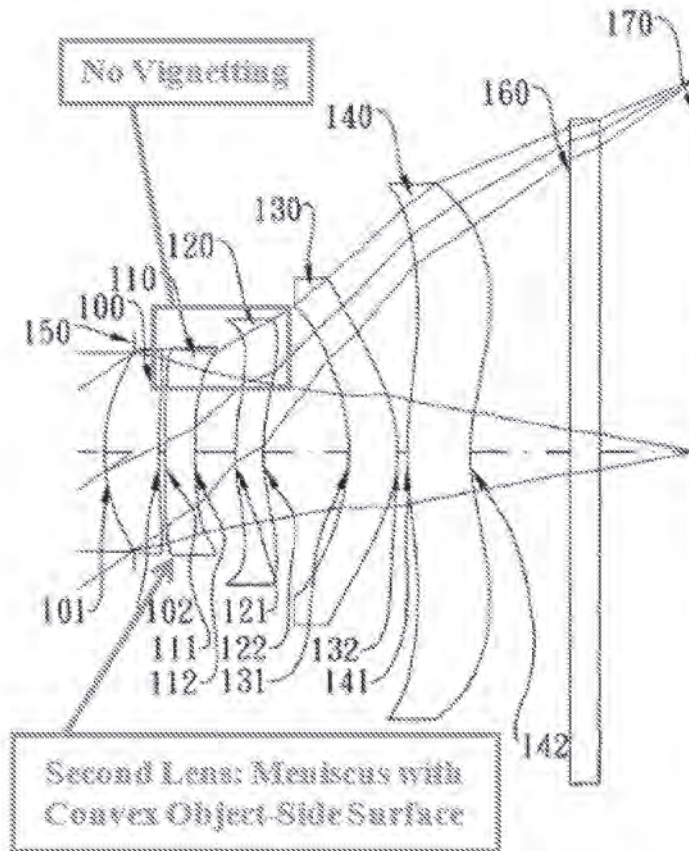
38) Chen describes a five-lens system like Ogino’s and the ’712 Patent. See Ex. C, Abstract, Fig. 1. And Chen’s lens assembly is similarly “applicable to high-resolution mobile



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phone cameras” (*see id.*, 1:29-31) and includes a meniscus-shaped L2 lens which, as shown below, reduces vignetting:



39) Reduced vignetting means that light rays at the outer edges of the lens pass through and reach the image plane. Ex. O, ¶45; *see, e.g.*, Ex. Q, p.188. Vignetting is a technique that lens designers consider when improving or modifying a lens design for a specific purpose. Ex. O, ¶45; *see, e.g.*, Ex. E, p.33. A POSITA would have recognize that Chen’s Example 1 does not employ vignetting at the second lens, which yields higher relative illumination than when vignetting is used in L2 of Ogino’s Example 5. Ex. O, ¶45. This lack of vignetting is a desirable benefit when lens designers are looking to maintain “illumination ... as uniform as possible across the entire field of view” of the lens system. *Id.*; *see* Ex. E, p.33.

40) This explanation of Chen is consistent with the Board’s summary in 896 IPR’s final written decision. *See* Ex. N, pp.19-20.

### 3. Bareau

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41) “The optics of miniature digital camera modules,” by Bareau et al. is an International Optical Design Conference proceeding from 2006 (63421F) and thus qualifies as a prior art reference for the ’712 Patent at least under AIA 35 U.S.C. § 102(a)(1). Although Bareau was cited in the Petition for the ’1146 IPR, Bareau was not combined with Ogino in that proceeding. Bareau was also not cited in the ’1356 IPR.

42) Bareau describes how “[d]esigning lenses for cell phone cameras is different from designing for traditional imaging systems” (*see* Ex. D, p.1) and offers “typical lens specifications” for use in cellular telephones, including an f-number of 2.8 or less to provide enough light to ¼” and smaller pixel sensor formats. *Id.*, pp.3-4. Bareau also specifies a short TTL (about 5.0 mm) to achieve thinner cell phones and a specification of relative illumination at the edge of the field of 50 percent or greater. *Id.*, pp. 3, 7. A POSITA would have understood these to be general specifications with some modifications allowed depending on the specific implementation, sensor, and desired purpose. *See* Ex. U, 1:30-53. Bareau also describes the understanding of a POSITA that designing lenses with a low f-number has been and continues to be an important trend in lens design. *See, e.g., id.*, pp.3-4. Bareau therefore serves as evidence that a POSITA would have considered two main driving factors for cell phone lens design—a small total track length (TTL) and a low f-number. *See* Ex. O, ¶64; Ex. D, pp.3-4.

43) This explanation of Bareau is consistent with the Board’s summary in 896 IPR’s final written decision. *See* Ex. N, pp.43.

### **C. Proposed Rejection**

44) The following analysis applies the combination of Ogino, Chen, and Bareau to claims 3-6, 8-11, and 14 of the ’712 patent and claims 1, 2, 12, and 13 from which claims 3-6, 8-11, and 14 depend. Because claims 3-6, 8-11, and 14 should be canceled for obviousness, as shown herein, the Office should also find obvious and cancel claims 1, 2, 12, and 13, consistent with Federal Circuit precedent. *See Callaway Golf Co. v. Acushnet Co.*, 576 F.3d 1331, 1344 (Fed. Cir. 2009) citing *Ormco Corp. v. Align Tech., Inc.*, 498 F.3d 1307, 1319 (Fed. Cir. 2007) (“A broader independent claim cannot be nonobvious where a dependent claim stemming from that independent claim is invalid for obviousness.”); *Ormco Corp.*, 498 F.3d 1319-20 (“Claim 10 is dependent on independent claim 1, and claim 17 is dependent on independent claim 11. Because claims 10 and 17 were found to have been obvious, the broader claims 1 and 11 must also have been obvious.”).



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45) Finally, Apple is only requesting reexamination of claims 3-6, 8-11, and 14 here, but the analysis in Exhibits M and O shows that the combination of Ogino, Chen, and Bareau also teaches all of the limitations of claims 1, 2, 7, 12, 13, 15, 16, and 19 and renders these claims obvious for the same reason. While Apple is estopped from requesting reexamination of these claims here under 35 U.S.C. § 315(e)(1), the Examiner may *sua sponte* reject these claims based on the analysis presented with this request and the accompanying exhibits. *See* 35 U.S.C. § 303(a) (“On his own initiative, and any time, the Director may determine whether a substantial new question of patentability is raised by patents and publications discovered by him or cited under the provisions of section 301 [of this title].”); *In re Etter*, 756 F.2d 852, 863 (Fed. Cir. 1985) (en banc) (Nies, J., concurring) (“[i]n a very real sense, once reexamination is ordered ... , the patent holder ‘starts over’ under the PTO view on all § 102 and § 103 issues with respect to all claims, amended or unamended, whether or not related to” a SNQ).

**1. Claims 3-6, 8-11, and 14 are unpatentable under 35 U.S.C. § 103 as being obvious over Ogino, Chen, and Bareau**

46) The following is a quotation of AIA 35 U.S.C. § 103 which form the basis of all the proposed rejections listed below:

103 A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

47) Claims 3-6, 8-11, and 14 and the claims from which they depend (1, 2, 12, and 13) are unpatentable under 35 U.S.C. § 103 as being obvious over Ogino, Chen, and Bareau, as shown by detailed explanation in the claim chart attached hereto as Exhibit M and Dr. Sasián’s declaration in Exhibit O. The combination proposed below—in which Ogino’s Example 5 lens design is modified to have (i) a second meniscus lens based on Chen, (ii) an f-number of 2.8 based on Bareau, and (iii) an increased D7 gap between the L3 and L4 lens elements based on Ogino’s conditional expression (10)—was found by the Board in the ’896 IPR’s final written decision to be an obvious combination. *See* Ex. N, pp.43-55. The lens assembly design derived from this combination, which was found to render claims 8-11 of the ’647 Patent obvious, also teaches each and every limitation of claims 1-16 and 19 here. *See* Ex. N, pp.42-51; Ex. M; Ex. O,



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p.41 et seq. In sum, this request simply applies the same lens design resulting from the combination of Ogino, Chen, and Bareau presented in the '896 IPR to the claims of the '712 Patent, which shows that those claims are obvious for the same reasons that the Board found in the '896 IPR. Because the Board already determined that a POSITA would have successfully arrived at the Ogino Example 5 design modified in light of Chen and Bareau, and because this modified design discloses all of the claim limitations as shown in Exhibits M and O, the claims subject to this request should be found obvious and canceled.

**a. Reasons to Combine Ogino and Chen to change the shape of the second lens element to meniscus**

48) A POSITA would have been aware of lens specifications related to mobile phones, as evidenced by Bareau (*see* Ex. D, p.3) including acceptable values for relative illumination, ray aberration, and the chief ray angle (CRA) at the sensor in modern mobile phone applications. *Id.*; Ex. O, ¶47. A POSITA also would have been aware, as Ogino recognizes, of the importance of reducing “deterioration in the light receiving efficiency and occurrence of color mixture due to increase of incident angle” to “achieve optimum optical performance.” Ex. B, 7:21-25; Ex. O, ¶47.

49) Modeling Ogino’s Example 5 with lens design software such as Zemax, however, would have revealed that it suffers from TIR vignetting on the second surface of the second lens, that it has aberrated rays that would need to be removed by further vignetting, thereby causing the relative illumination at the edge of the field to fall to 40%, and that the CRA for the full field is 38 degrees. *See* Ex. O, ¶48, Fig. 1A. Despite these problems, a POSITA would have been interested in Ogino’s Example 5 because of its short total track length (5.273 mm), its lowest telephoto ratio (0.885) of Ogino’s examples, and its inclusion with other embodiments having much lower f-numbers, thus indicating that it was ripe for modification to satisfy the industry trend of more compact and brighter telephoto lenses. *Id.*, ¶48.

50) Accordingly, that POSITA would have been motivated to modify Example 5 to achieve benefits like reduced vignetting, improved relative illumination, and reduced aberration to produce brighter, higher quality images. *Id.*, ¶49. Given the Chen reference, a POSITA would have found it obvious to combine Chen’s meniscus second lens that does not cause vignetting with Ogino’s Example 5 lens system to provide the same benefit seen in Chen—of decrease vignetting and ray aberration—in Ogino’s similar five-lens system. *Id.*



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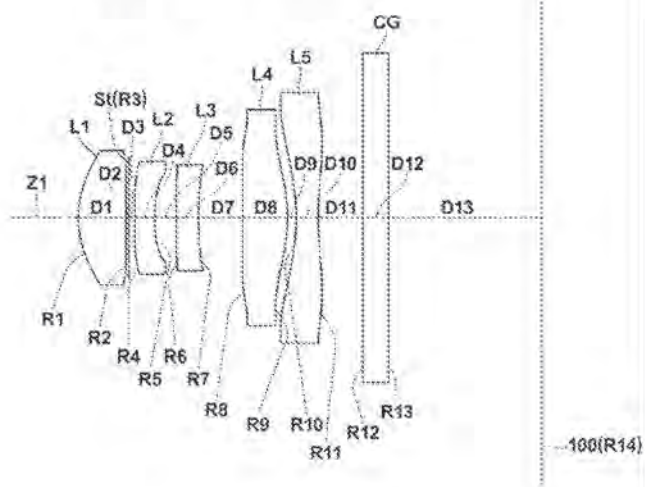
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51) Ogino and Chen both describe five-lens systems. *See, e.g.*, Ex. B, Abstract; Ex. C, Abstract. In both Ogino and Chen, all lens elements are aspheric. Ex. B, 13:3-5; Ex. C, 6:51-7:4. Additionally, the first lens in each system is meniscus (i.e., convex toward the object side) having positive refractive power (*see* Ex. B, 7:28-31; Ex. C, 6:52-53); the second lens has a negative refractive power (*see* Ex. B, 23:30-40, Table 13; Ex. C, 6:55-57); the third lens is a meniscus shape (convex toward the object side) having negative refractive power (*see* Ex. B, 7:58-63; Ex. C, 6:59-62); the fourth lens is a meniscus shape (convex toward the image side) having positive refractive power (*see* Ex. B, 7:64-8:1; Ex. C, 6:62-65); and, the fifth lens is a meniscus shape (convex toward the image side) having negative refractive power (*see* Ex. B, 8:8-25; Ex. C, 6:66-7:4). Ex. O, ¶50.

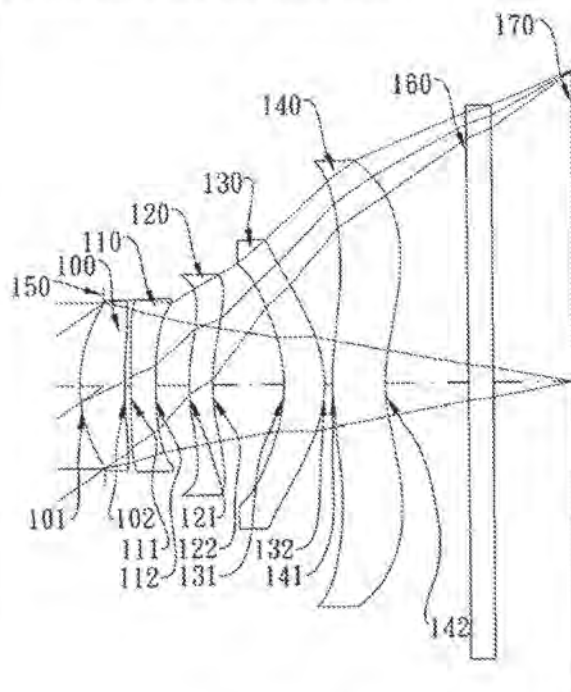
52) Example 5 from Ogino and Example 1 from Chen are provided below:

**FIG.5**

EXAMPLE 5



Ogino, Fig. 5



Chen, Fig. 1

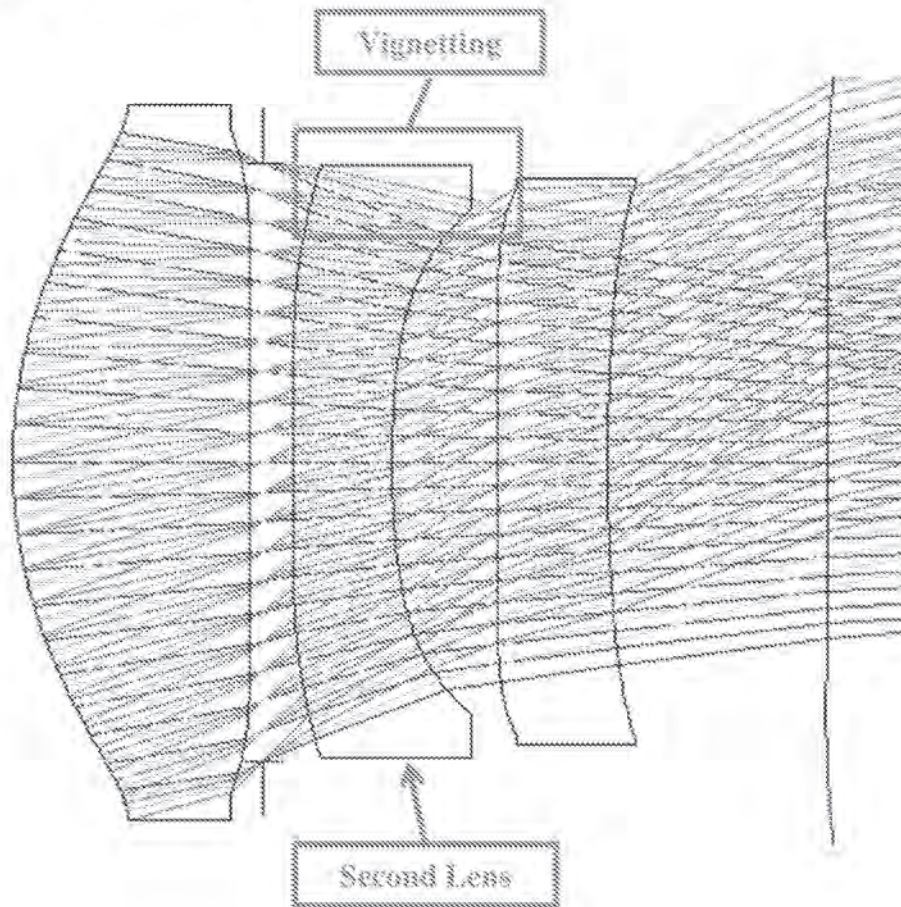
53) The second lens elements in Ogino's and Chen's lens systems have negative refractive power but differ in that Ogino's has a biconcave shape and Chen's has a meniscus shape (convex toward the object side). *See* Ex. B, Table 13; Ex. C, 6:55-59. However, Chen's lens system passes more light through the second lens and does not use vignetting to control off-axis ray aberration. *Id.*, ¶52.

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54) As observed from the model of Ogino's Example 5 created using the Zemax lens design software (a program used by POSITAs to design and model lens systems), some of the edge rays refracted by the second lens do not pass through it and instead, are effectively blocked by total internal reflection. *Id.*, ¶53. This effect is known as vignetting (*see* Ex. Q, p.188) and is shown in the magnified model of Example 5 below:

**Ray Tracing of Ogino Example 5 magnified**



*Id.*

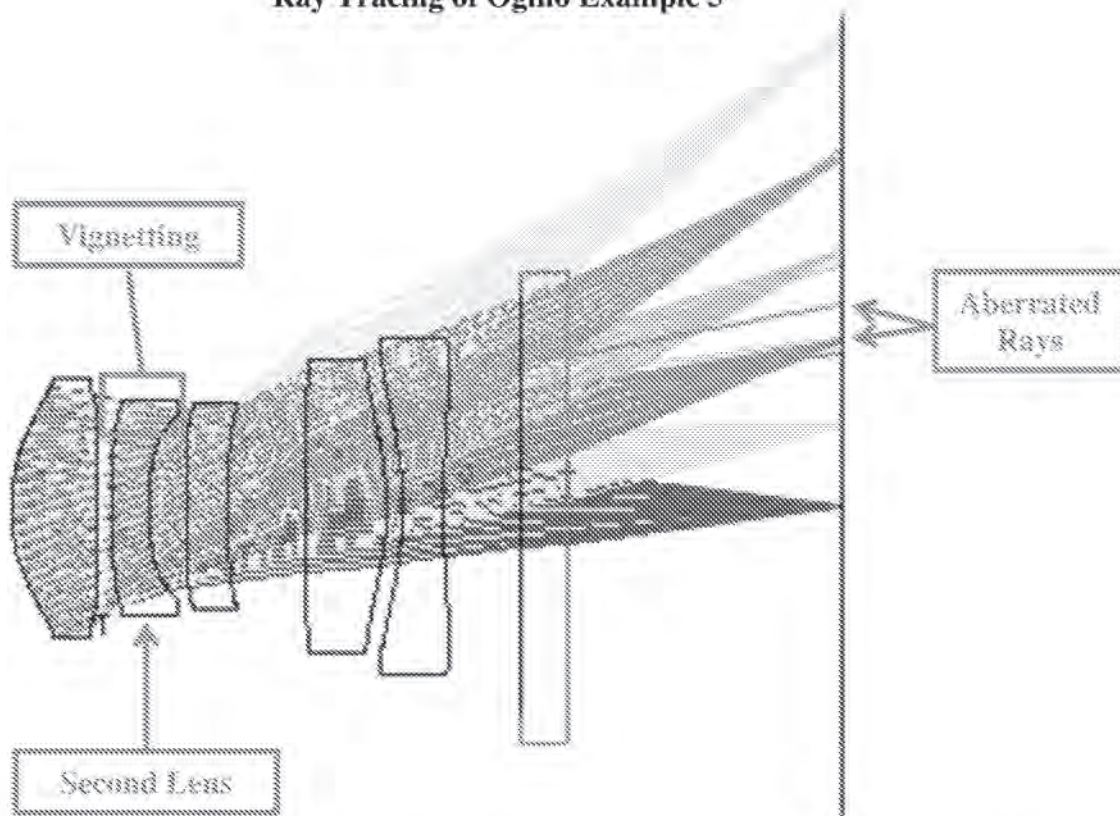
55) Further, some off-axis rays (shown in pink and yellow) are shown to be substantially aberrated:



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### Ray Tracing of Ogino Example 5



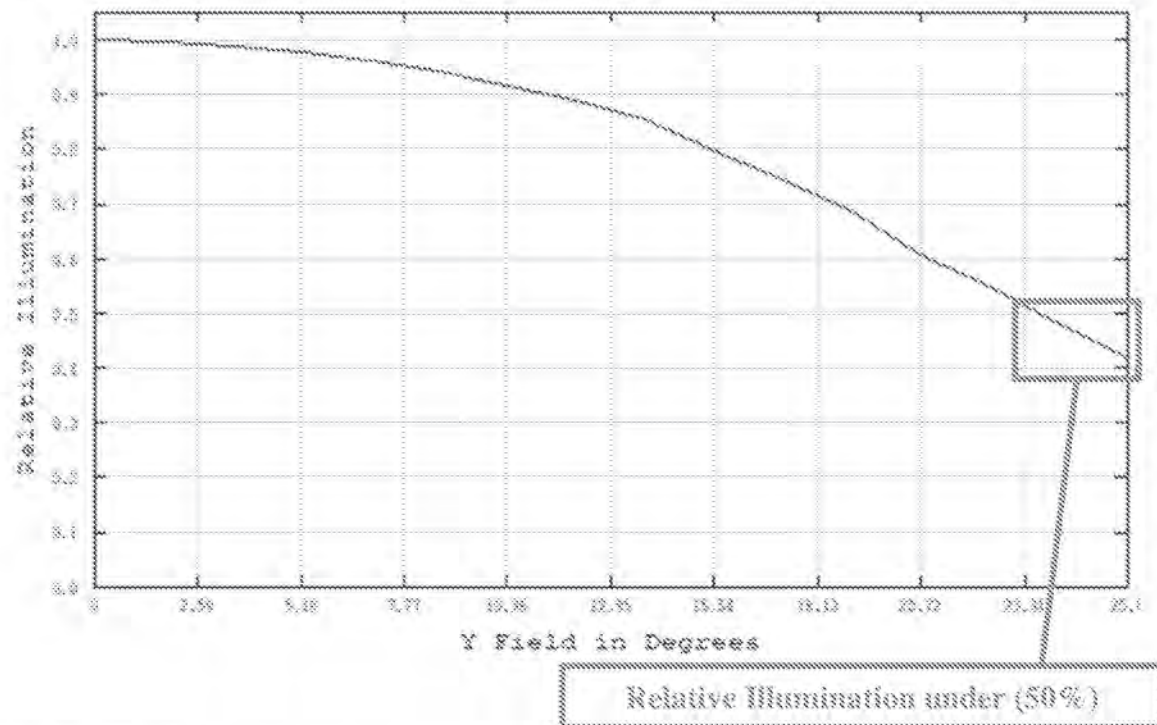
*Id.*, ¶53.

56) POSITAs developing lens systems may deliberately introduce vignetting to “obliterate undesirable off-axis aberrations.” *Id.*, ¶54; Ex. Q, p.188. While vignetting may help to reduce undesirable aberrations, it also reduces the relative illumination of the lens system. *See* Ex. Q, p.188. Such reduction may be beneficial for some cases but for lens systems designed for cellular telephones, like in Ogino and Chen, it is desirable for relative illumination to be greater than 50% at the edge of the field. *See* Ex. O, ¶54; Ex. D, p.3, 7. Specifying relative illumination greater than 50% at the edge of the field means that the brightness at the edge of the field of view should be no less than 50% of the brightness at the center. Ex. O, ¶54. Ogino’s Example 5 fails this because, as shown in the Zemax chart below, the relative illumination is below 50% at the edge of the field of view. Ex. O, ¶54; Consequently, a POSITA would have looked at also improving the relative illumination of Ogino’s Example 5. *Id.*

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**Fig. 1B - Relative Illumination of Ogino Example 5**



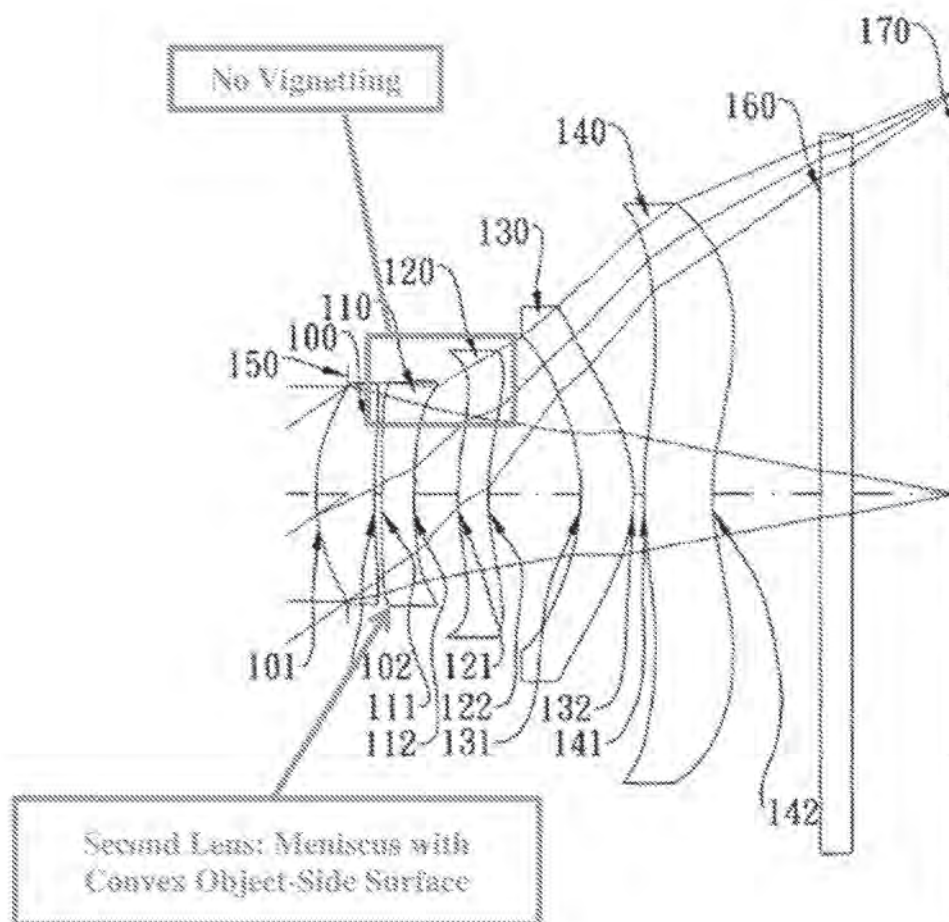
*Id.*, ¶54, Fig. 1B (annotated).

57) Where the biconcave second lens of Ogino's Example 5 employs vignetting, the meniscus second lens of Chen does not. *Id.*, ¶55. This is observed in the ray tracing provided in Fig. 1 of Chen, reproduced below:



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*Id.*, ¶55; Ex. C, Fig. 1 (annotated).

58) Further, a POSITA would have recognized that the optical shape of the second lens impacts vignetting, and in view of Chen would have sought to change the optical shape of Ogino's second lens. In course of routine optimization that POSITA would have found lens solutions with a meniscus second lens as shown in Chen's Fig. 1 above. *Id.*, ¶56.

59) Modifying the second lens of Ogino's Example 5 to be meniscus-shaped, as taught by Chen, would have been a routine lens adjustment for a POSITA. *Id.*, ¶57. First, Ogino indicates that modifications can be made to its lens design, including changing the radius of curvature (i.e., shape) of each lens surface:

The imaging lens of the present invention is not limited to the above-mentioned embodiments and examples, and may be modified to various forms. For example, the values of the radius of curvature, the on-axis Surface spacing, the refractive index, the Abbe number, the aspheric surface coefficient, and the like of the lens elements are not limited to the values shown in the numerical examples, and may have different values.

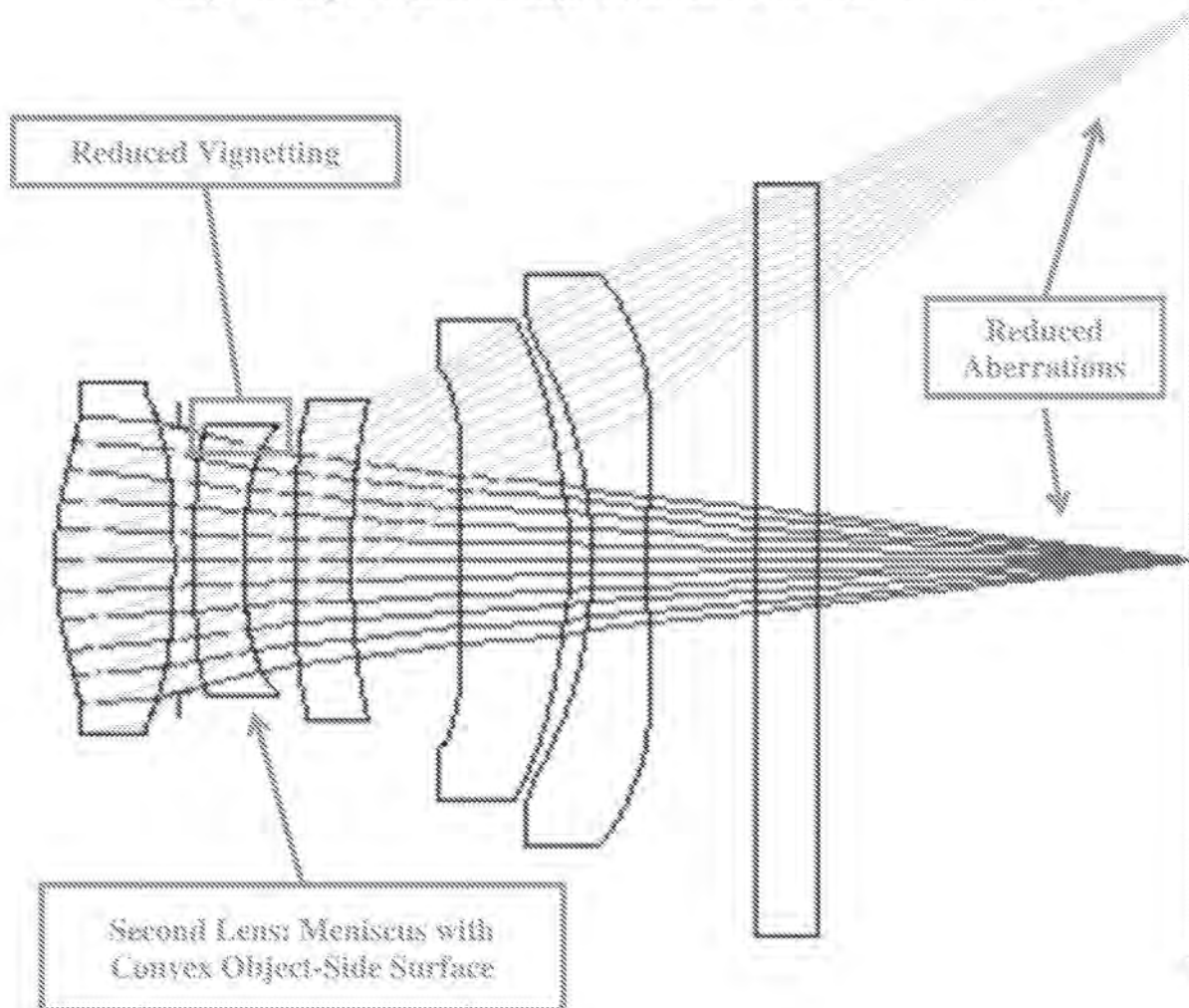
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Ex. B, 16:11-19. Further, a POSITA would have known that changing the curvature of a lens surface is a standard improvement technique used to reduce aberrations. *See* Ex. O, ¶57; Ex. E, pp.25, 33-37. Changes to lens designs are generally performed using computer software and following the lens design process taught in Fischer (*see* Ex. S, p.171-76) to both input and modify lens data and analyze the results. *See* Ex. O, ¶57; Ex. E, pp.3-23. Zemax, used in the analysis here, was and is a common software tool for lens design and modeling. Ex. O, ¶57.

60) When the teaching of using a meniscus second lens, as disclosed in Chen, and routine optimization is applied to the lens system in Ogino's Example 5, vignetting and ray aberrations are reduced. *Id.*, ¶58. This is shown in the model below, illustrating a ray trace of Example 5 modified with a meniscus-shaped second lens, as disclosed in Chen:

**Ray Tracing of Ogino Example 5 (modified L2 meniscus) at F/3.94**





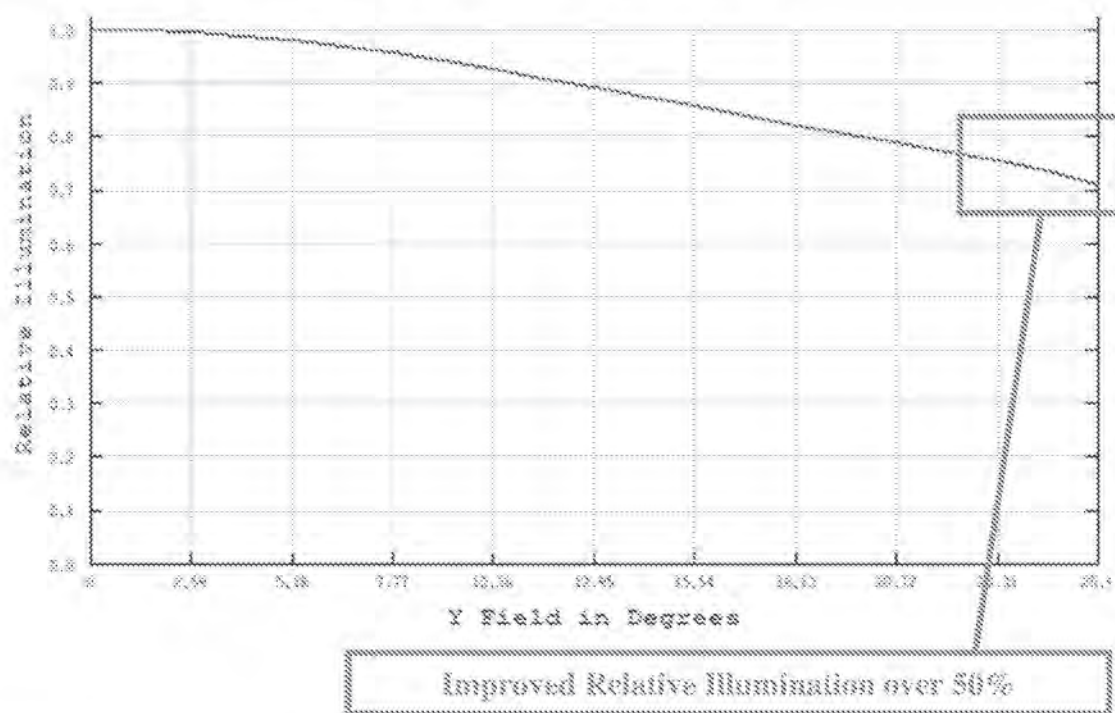
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Ex. O, ¶58, Fig. 2A (annotated). In the modified design, EFL=5.460 mm, TTL=5.273 mm, and thickness and spacing of L1-L5 remain unchanged. *Id.* The focal lengths  $f_1$  and  $f_2$  as calculated by Zemax change slightly due to software optimization with the L2 lens having a meniscus shape. *Id.* But, as supported by the data in Figs. 2A below, the limitations addressed in claim 1 continue to be satisfied. *Id.*

61) Changing the object-side surface of L2 in Ogino's Example 5, thus making it meniscus as taught in Chen, and routine optimization lead to reducing vignetting as expected and improved relative illumination greater than 50% at the edge of the field. *Id.*, ¶59. The improved relative illumination chart is provided below:

**Fig. 2B - Relative Illumination Ogino Example 5 (modified)**



*Id.*, ¶59, Fig. 2B (annotated). This lens adjustment would also have had the benefit of reducing ray aberration. *See id.*, ¶59, Fig. 2A.

62) Accordingly, a POSITA would have been motivated to modify Ogino's Example 5 lens assembly by applying Chen's teaching of a meniscus shape for the negative second lens, as Chen shows no vignetting and, as observed above, the vignetting in Ogino starts at the second lens. *Id.*, ¶60.

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63) As illustrated by the ray trace diagrams above of Ogino's original lens system, and of Ogino's lens system modified with a meniscus second lens, such a modification could have been accomplished by a POSITA where the modified lens system would have maintained its original structure but would have provided better relative illumination and lower ray aberration, *Id.*, ¶61. The modified lens system would have been more desirable for use in portable devices such as cellular telephones. *Id.* Such a combination would have been nothing more than applying Chen's meniscus-shaped second lens to Ogino's second lens, and routine optimization to similarly improve Ogino's five-lens system. *Id.*

**b. Reasons to Combine Ogino, Chen, and Bareau to lower the f-number of Ogino's Example 5 with a second meniscus lens to 2.8**

64) A POSITA would have found it obvious to modify Ogino's Example 5 lens assembly based on Bareau's specifications for cell phone camera lenses desiring an  $F\#=2.8$  or less for  $\frac{1}{4}$ " and smaller pixel image sensors. *Id.*, ¶66. Such a combination would have been nothing more than applying Bareau's specification for a bright lens system (i.e.,  $F\#=2.8$ ), according to known lens design and modification methods (as taught in Ex. S, p.172), to yield a predictable result of Ogino's Example 5 lens assembly likewise supporting an f-number of 2.8 or lower for a  $\frac{1}{4}$ " sensor format. *See* Ex. O, ¶66; Ex. D, pp.3-4. A POSITA would have found it obvious to lower the f-number of Example 5 whether original or modified with a meniscus L2 lens for the same reasons discussed below. Ex. O, ¶66. This is shown in the modified design in Fig. 3A of Dr. Sasián's declaration, working at  $F\#=2.8$  and using the L2 lens with a meniscus shape. *See* Ex. O, Appendix Fig. 3A.

65) Bareau was published in 2006. Ex. C, p.1. By 2013 (the priority date of the '647 Patent), cell phones having cameras with an f-number of 2.8 or lower for  $\frac{1}{4}$ " were common and it was at least expected that cell phone camera lenses would satisfy similar specifications. *See id.*, p.3; Ex. U, 1:39-42. A POSITA's desire to achieve lens designs with lower f-numbers was also well known and driven by a recognized need for "faster" lenses. *See* Ex. O, ¶67; Ex. T, p.104 ("The tremendous efforts of lens designers and manufacturers that have been devoted to the production of lenses of extremely high relative aperture are an indication of the need that exists for brighter images and 'faster' lenses."). To have a competitive lens design, a POSITA therefore would have sought to modify existing lens designs to achieve faster f-numbers like 2.8



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while still maintaining a short total track length appropriate for thin cell phone designs. Ex. O, ¶¶67.

66) A POSITA thus would have been aware of Bareau's specifications for lens assemblies designed for modern cellular telephones and particularly the importance of supporting a faster f-number for smaller pixel sensor formats. *Id.*, ¶¶68. Consequently, a POSITA looking to implement a telephoto lens in a cell phone with, for example, a common 1/4" sensor format would have been motivated to look to lens designs like Ogino's that could support a lower, more desirable f-number since Ogino's other embodiments support f-number values down to 2.45 as discussed above. *Id.* Thus, modifying Ogino's Example 5 to have an f-number of 2.8, as taught in Bareau, would have been nothing more than applying Bareau's specification of an  $F\# = 2.8$  for a 1/4" image sensor format according to known lens design methods (as taught in Fischer (Ex. T)) to allow Example 5 to likewise better support a 1/4" sensor format in a thin cell phone. *Id.*

67) While Bareau specifies a field of view (FOV) of 60 degrees, this would have been understood to be a design consideration since most cell phones at the time used a single wide lens. *See, e.g., id.*, ¶¶69; Ex. B, Figs. 14, 15. A POSITA designing a cell phone, though, would have recognized that Bareau's specifications for f-number and short TTL would still be highly relevant to incorporating a telephoto lens like Example 5 since TTL dictates the thickness of the cell phone and the f-number indicates how much light reaches the image sensor pixels regardless of a lens's focal length or FOV. *See* Ex. O, ¶¶69; Ex. D, pp.3-4. Based on these considerations, a POSITA seeking a telephoto lens with a low f-number would have looked to modify Ogino's Example 5 since Ogino's other examples support lower f-numbers and modifying an existing lens design takes far less time than starting from scratch, and lens designers often start designs using existing examples in the patent literature. Ex. O, ¶¶69.

68) A POSITA would have understood that one way of modifying Ogino's Example 5 is to increase the diameter of one or more lens element surfaces, particularly the first lens L1 in Example 5 because L1 serves as the entrance aperture. *Id.*, ¶¶70. This is due to the relationship between f-number, focal length (EFL), and the diameter of the entrance aperture (i.e., the entrance pupil diameter EPD) which controls the amount of light that enters the assembly:

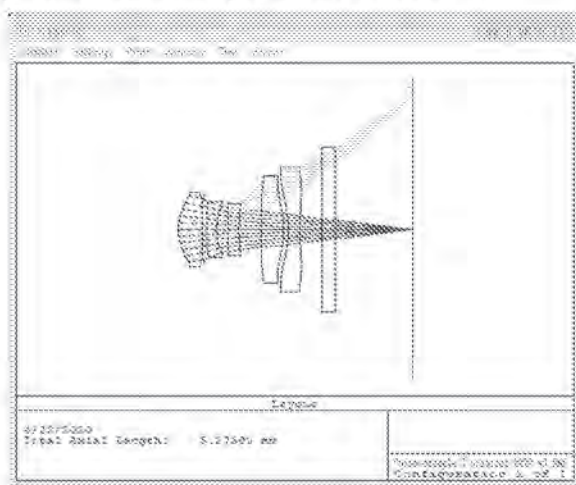
$$f\text{-number} = \frac{EFL}{\text{diameter}} = \frac{EFL}{EPD}$$

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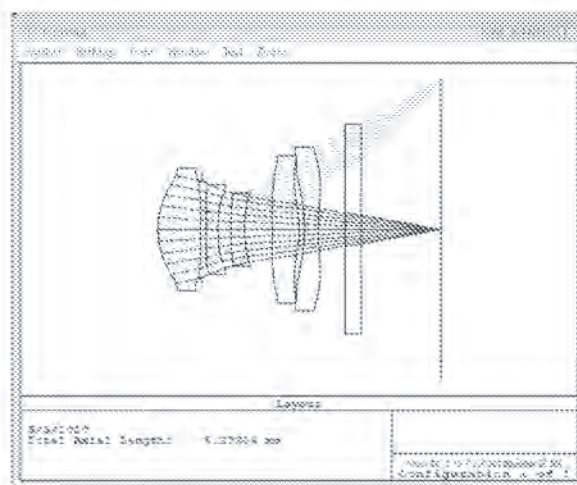
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See Ex. R, p.59. Given the arrangement of the lenses in Example 5 where the aperture is located behind the first lens L1, a POSITA would have recognized that increasing the diameter of L1's surfaces would thereby also increase the aperture and allow more light to enter the system. See Ex. O, ¶70; Ex. R, pp.60, 67-69 (explaining that a change in the entrance pupil or aperture stop leads to a change in the diameter of the lens).

69) Modifying Example 5 to achieve the Bareau's preferred  $F\#=2.8$  and using well-known lens design software to find the best solution, a POSITA would have arrived at one possible lens design as shown below:



**Ogino Example 5 ( $F\#=3.94$ )**



**Example 5 modified  $F\#=2.8$   
and L2 meniscus**

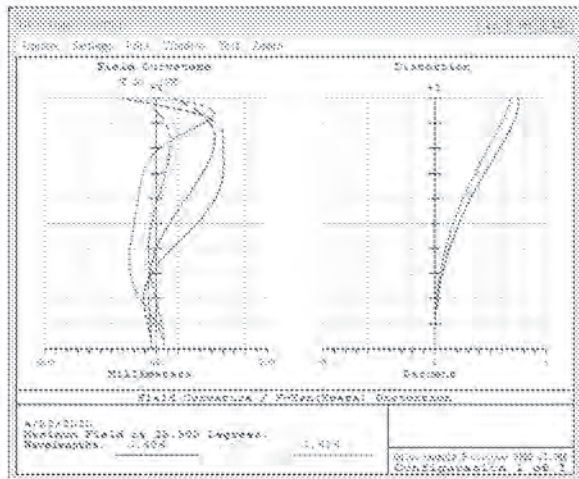
See Ex. O, ¶71, Figs. 1A, 3A. In the modified design,  $EFL=5.569$  mm,  $TTL=5.274$  mm, and thickness and spacing of L2-L5 remain unchanged. *Id.*, ¶71. The focal lengths  $f_1$  and  $f_2$  as calculated by Zemax change slightly due to software optimization the L2 lens having a meniscus shape and increasing the diameter of the aperture. *Id.* But, as supported in Figs. 3A-3D below the limitations addressed in claim 1 continue to be satisfied. *Id.*

70) Accordingly, Example 5 at  $F\#=2.8$  (and meniscus L2) maintains the same structural design (i.e., similar focal lengths and spacing) and similar performance characteristics when compared to the original Example 5 design. *Id.*, ¶72. This is shown by comparing the analysis produced by Zemax below:

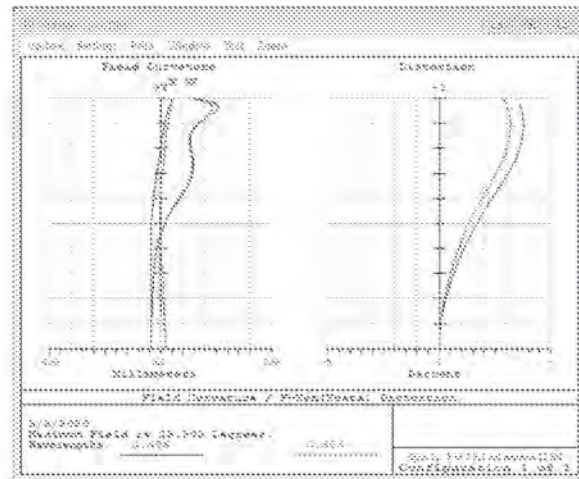


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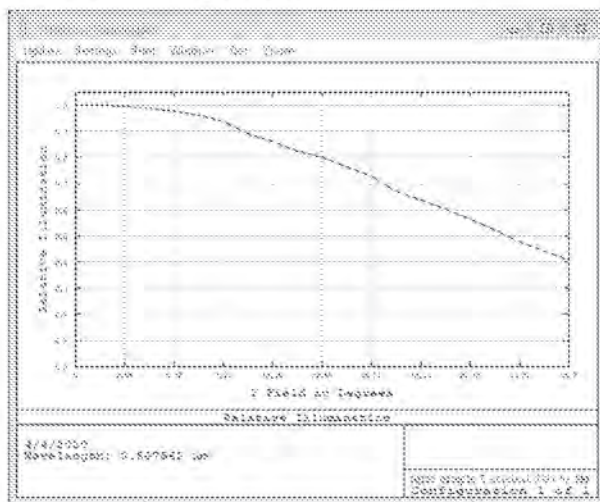


**Ogino Example 5 (F#=3.94)**

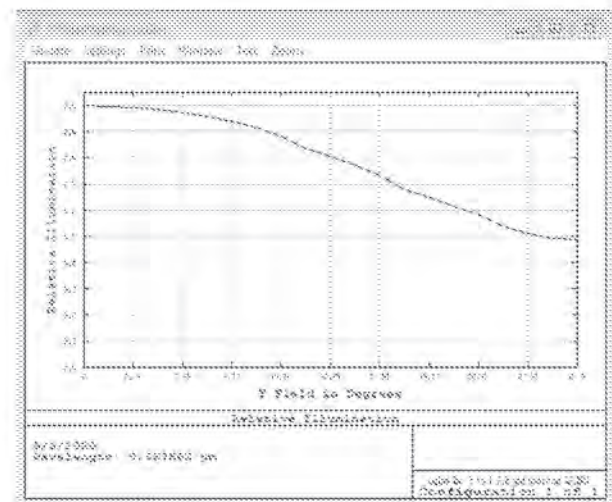


**Example 5 modified F#=2.8  
 and L2 meniscus**

See *id.*, ¶72, Figs. 1C, 3C.



**Relative Illumination of  
 Ogino Example 5 (F#=3.94)**



**Relative Illumination of Example 5  
 modified F#=2.8 and L2 meniscus**

See *id.*, ¶72, Figs. 1B, 3B.

71) Based on the foregoing reasons, a POSITA thus would have found it obvious, desirable, and predictable to lower the f-number of Example 5 to 2.8 or lower based on Bareau's cell phone lens typical specification of F/2.8 and 1/4" sensor, and would have succeeded in doing so as evidenced by the modified design above. *Id.*, ¶73.

72) As discussed above and has been found by the Board, a POSITA would have been motivated and found it obvious to modify Example 5's L2 lens to be meniscus to improve relative illumination and to reduce ray aberration. See Ex. N, pp.26-30. As has already been



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found by the Board, a POSITA would have been motivated to further modify Example 5 with L2 being meniscus (addressed in the Reasons to Combine Ogino and Chen) to lower the f-number to 2.8 so that the lens design would be more compatible with modern cell phone camera specifications that require more light to reach a ¼" image sensor. *See* Ex. N, pp.42-47.

**c. Reasons to Modify Ogino Example 5 to increase the spacing of the D7 Gap based on Ogino's conditional expression (10)**

73) As discussed above in the "Reasons to combine Ogino and Chen" a POSITA would have been motivated and found it obvious to modify the L2 lens to be meniscus to improve relative illumination and to reduce ray aberration. As discussed in the "Reasons to combine Ogino, Chen, and Bareau," a POSITA would have been motivated to further modify Example 5 with L2 being meniscus to lower the f-number to 2.8 so that the lens design would be more compatible with modern cell phone camera specifications that require more light to reach a ¼" image sensor. Modifying Ogino in this way (L2 meniscus and F#2.8) yields a predictable result that still maintains similar structure, within the teachings of Ogino, and performance to the original Example 5 design. Ex. O, ¶74.

74) A POSITA also would have found it obvious to modify Ogino's Example 5 with a second meniscus lens and an f-number of 2.8 to increase the gap (D7) between the L3 and L4 lens elements. *Id.*, ¶75. The Board has already determined that a POSITA would have been so motivated and successful at arriving at this modified design (*see* Ex. N, pp.47-51), which is the lens design applied to the claims shown in Exhibit M and supported by Dr. Sasián's declaration at Exhibit O.

75) The teaching to increase the D7 gap is expressly provided by Ogino's conditional expression (10) described as follows:

Further, it is desirable that the spacing D7 on the optical axis between the third lens L3 and the fourth lens L4 and the focal length f of the whole system satisfy the following conditional expression (10):

$$0.05 < \frac{D7}{f} < 0.2$$

Conditional expression (10) defines a desirable numerical range of a ratio of the spacing D7 on the optical axis between the third lens L3 and the fourth lens L4 to the focal length f of the whole system. By Securing the spacing D7 on the optical axis between the third lens L3 and the fourth lens L4 relative to the focal length f of the whole system such that D7/f is greater than the lower limit of the conditional expression (10), it is possible to appropriately suppress distortion which tends to



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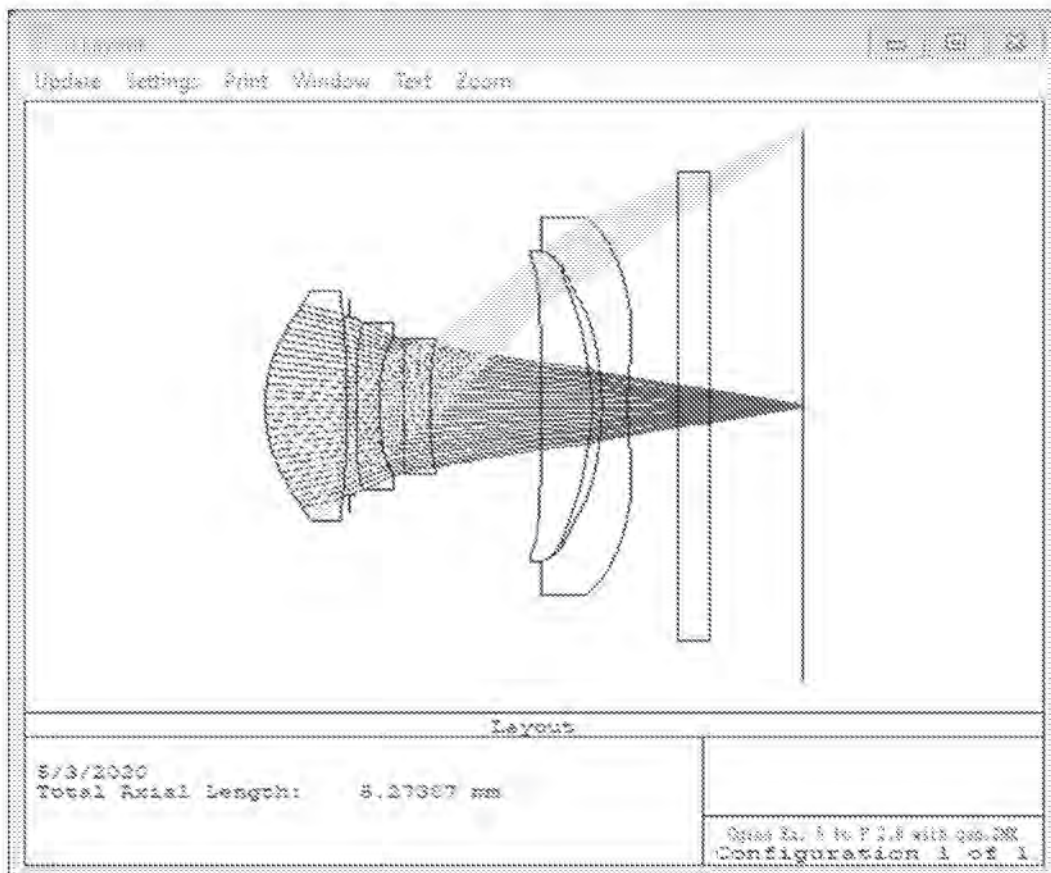
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occur when the total length is reduced. By maintaining the spacing D7 on the optical axis between the third lens L3 and the fourth lens L4 relative to the focal length  $f$  of the whole system such that  $D7/f$  is less than the upper limit of the conditional expression (10), it is possible to satisfactorily correct astigmatism.

Ex. B, 12:51-63.

76) For Example 5 where D7 represents the gap between the L3 and L4 lens elements, this conditional expression instructs a POSITA that the gap can be modified to a range between 0.298 mm and 1.191 mm. Ex. O, ¶76. Example 5 as provided in Ogino's Table 9 shows D7 at 0.506 mm, at the lower end of the conditional expression. *Id.* Because Ogino provides this range, a POSITA would have found it obvious to try to modify the Example 5 design to see if any benefits could be gained by increasing the gap between the L3 and L4 lens elements. *Id.* Thus, it would have been obvious for a POSITA to try to increase the D7 gap to a distance closer to the maximum allowed by conditional expression (10) for Example 5 of 1.191 mm. *Id.*

77) One possible predictable result of these modifications of Example 5 is provided below with prescription data included in the Appendix. *See id.*, Figs. 4A-4D.

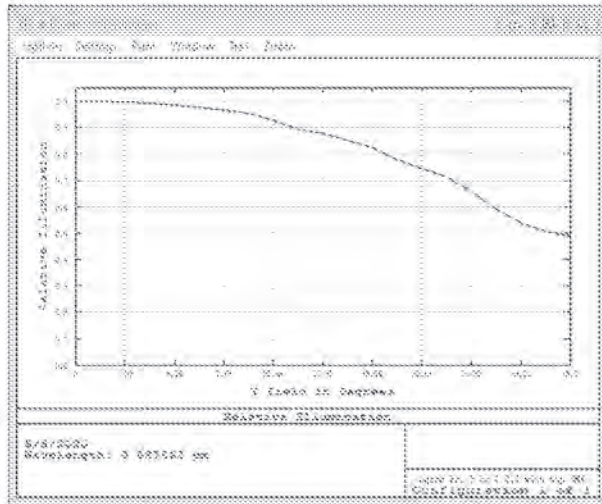


*See id.*, Appendix Fig. 4A.

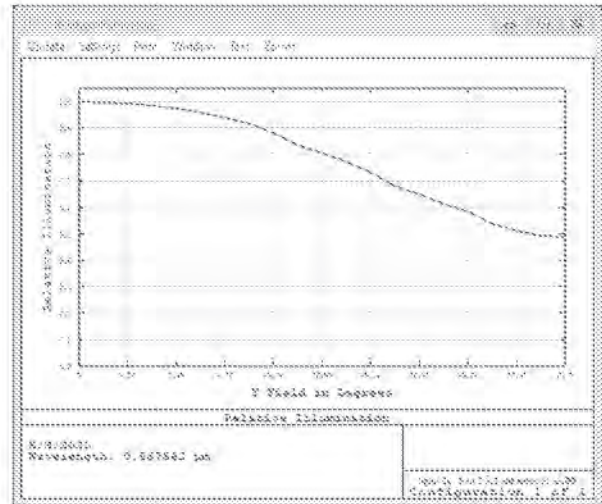
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78) When Ogino's conditional expression (10) is applied to Ogino 5 modified for a meniscus L2 lens and  $F\#=2.8$ , a POSITA would have realized better performance with an increased D7 gap. *Id.*, ¶78. This can be observed by comparing Example 5 modified for  $F\#=2.8$  and meniscus L2 (Figs. 3A-3D) against the modification that includes increasing the D7 gap (Figs. 4A-4D):

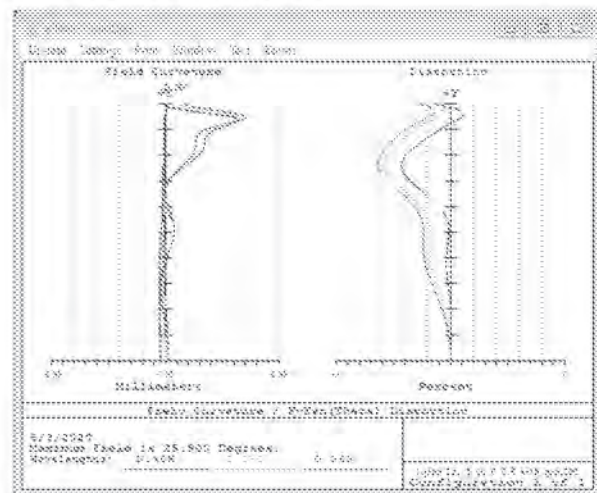


**Relative Illumination of Example 5 modified  $F\#=2.8$ , meniscus L2, and D7 gap (Fig. 4B)**

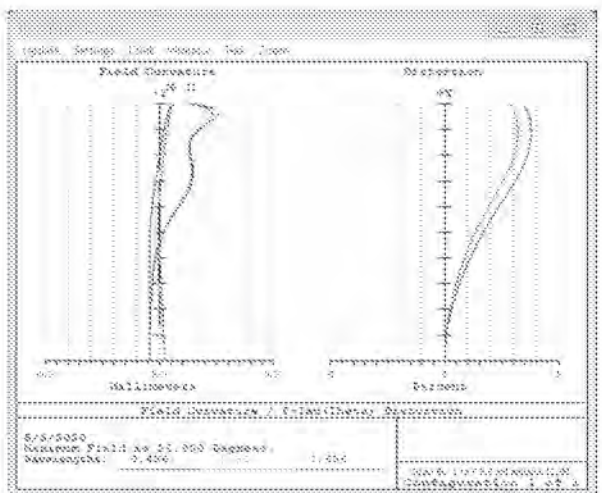


**Relative Illumination of Example 5 modified  $F\#=2.8$  and meniscus L2 (Fig. 3B)**

See *id.*, ¶78, Fig. 3B, 4B.

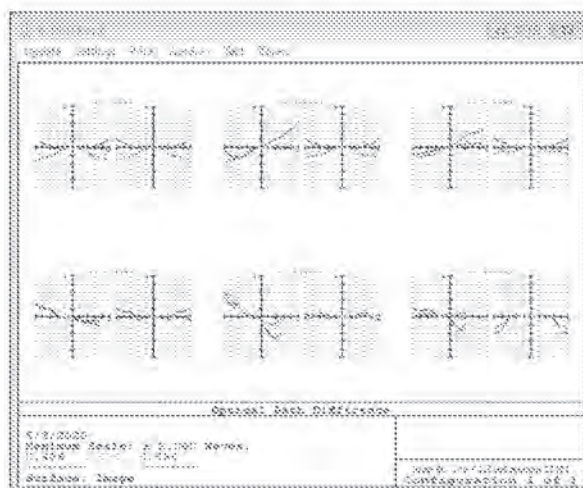


**Field curvature of Example 5 modified  $F\#=2.8$ , meniscus L2, and D7 gap (Fig. 4C)**



**Relative Illumination of Example 5 modified  $F\#=2.8$  and meniscus L2 (Fig. 3C)**





**Wavefront (OPD) of Example 5 modified  
F#=2.8 and meniscus L2 (Fig. 3C)**

79) This modified version of Example 5 maintains the same TTL of 5.273 mm thus yielding a TTL/5 of 1.055 mm. *Id.*, ¶79. The D7 gap, though, has been increased to 1.085 mm which is greater than 1.055 mm. The analysis in Exhibit M and Exhibit O address this modified version, to the extent that differences exist between it and Ogino's original Example 5. Otherwise, reference will be made to original Example 5's properties to the extent they are maintained in the modified version applied in Exhibit M.

80) Copies of the patents, printed publications, and other documents relied upon or referenced in the detailed explanation above are provided as the following exhibits:

Exhibit A	United States Patent No. 9,568,712 (“the ’712 Patent”)
Exhibit B	Ogino et al., U.S. Patent No. 9,128,267, filed March 24, 2014 (claiming priority to Japanese Application No. 2013-072282 filed March 29, 2013), issued September 8, 2015 (“Ogino”)
Exhibit C	Chen, U.S. Patent No. 8,233,224, filed January 8, 2010 (claiming priority to Taiwanese Application No. 98123694A filed July 14, 2009), issued July 31, 2012 (“Chen”)

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Exhibit D	Bureau et al., "The optics of miniature digital camera modules," SPIE Proceedings Volume 6342, International Optical Design Conference 2006; 63421F (2006) <a href="https://doi.org/10.1117/12.692291">https://doi.org/10.1117/12.692291</a> ("Bureau")
Exhibit E	Warren J. Smith, MODERN LENS DESIGN (1992) ("Smith")
Exhibit F	Final Written Decision in IPR2018-01146 (Paper 37)
Exhibit G	<i>Apple Inc. v. Corephotonics, LTD</i> , CAFC-20-1438, Decision (Document 46)
Exhibit H	Institution Decision in IPR2018-01356 (Paper 9)
Exhibit I	<i>Apple Inc. v. Corephotonics LTD</i> , Case No. 5:18-cv-02555, Order Staying Cases
Exhibit J	Prosecution History of U.S. Patent No. 9,568,712
Exhibit K	Petition filed in IPR2018-01146 (Paper 2)
Exhibit L	Petition filed in IPR2018-01356 (Paper 2)
Exhibit M	Claim Chart for Claims 1, 2, 6, and 12-14 (Ogino, Chen, and Bureau)
Exhibit N	Final Written Decision in IPR2020-00896 (Paper 33)
Exhibit O	Declaration of Dr. Jose Sasián in support of Request
Exhibit P	Curriculum vitae Dr. Jose Sasián
Exhibit Q	Max Born et al., PRINCIPLES OF OPTICS, 6 <sup>th</sup> Ed. (1980) ("Born"),
Exhibit R	Bruce J. Walker, OPTICAL ENGINEERING FUNDAMENTALS (1995) ("Walker")
Exhibit S	Robert E. Fischer, OPTICAL SYSTEM DESIGN (2008) ("Fischer")
Exhibit T	Rudolf Kingslake, OPTICS IN PHOTOGRAPHY (1992) ("Kingslake")
Exhibit U	Wang, U.S. Patent No. 7,321,475, issued January 22, 2008 ("Wang")
Exhibit V	Petition filed in IPR2020-00896
Exhibit W	Alan Symmons & Michael Schaub, FIELD GUIDE TO MOBILE OPTICS (2016) ("Schaub")

## IX. CONCLUSION

81) For the reasons set forth above, it is clear that a substantial new question of patentability is raised in connection with claims 3-6, 8-11, and 14 of the '712 Patent by this Request for *Ex parte* Reexamination since these claims are rendered obvious in view of the



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combination of Ogino, Chen, and Bareau (as found by the Board in the '896 IPR). Therefore, it is requested that reexamination be granted for at least claims 3-6, 8-11, and 14, and that at least these claims be finally rejected and canceled.

82) As identified in the attached Certificate of Service and in accordance with 37 CFR §§ 1.33(c) and 1.510(b)(5), a copy of the present request, in its entirety, is being served to the address of the attorney or agent of record.

83) Please direct all correspondence in this matter to the undersigned.

Dated: December 9, 2021  
HAYNES AND BOONE, LLP  
2323 Victory Avenue, Suite 700  
Dallas, TX 75219

Customer No. 27683  
Telephone: 972/739-8611  
Facsimile: 214/200-0853

Respectfully submitted,

/Michael S. Parsons/  
Michael S. Parsons  
Registration No. 58,767

**CERTIFICATE OF TRANSMISSION**

I hereby certify that this correspondence, all attachments, and any corresponding filing fee is being transmitted via the Electronic Filing System (EFS) Web with the United States Patent and Trademark Office on December 9, 2021.

/Theresa Lowe/  
Theresa Lowe

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**CERTIFICATE OF SERVICE**

The undersigned certifies that copies of the following:

- (1) Request for *Ex parte* Reexamination Transmittal Form;
- (2) PTO 1449 Modified Form;
- (3) Request for *Ex parte* Reexamination; and
- (4) Exhibits A-W

in their entity were served on:

Nathan & Associates Patent Agents Ltd  
P.O. Box 10178  
Tel Aviv 6110101

the attorney of record for the assignee of U.S. Patent No. 9,568,712 in accordance with 37 CFR  
§ 1.510(b)(5), on December 9, 2021

/Michael S. Parsons/

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